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## NOTES FOR STUDENTS.

THE THIRTEENTH PART (Jour. Linn. Soc. **26** : 538–561. 1902) of Forbes and Hemsley's "Enumeration of all the plants known from China proper, Formosa, Hainan, Corea, the Luchu archipelago, and the Islands of Hongkong" contains the gymnosperms of that very interesting region, the enumeration being as follows: Gnetales 5 spp. (Ephedra 4, Gnetum 1); Coniferales 64 spp. (Libocedrus 1, Thuja 1, Cupressus 2, Juniperus 7, Cryptomeria 1, Glyptostrobus 1, Cephalotaxus 5, Taxus 1, Torreya 2, Podocarpus 6, Cunninghamia 1, Pinus 11 [1 new], Picea 6, Keteleeria 4 [2 new], Tsuga 4, Abies 4, Pseudolarix 1, Larix 6); Ginkgoales 1 sp.; Cycadales 4 spp. (Cycas). —J. M. C.

THE GERMINATION of dry seeds after exposure to high temperatures has been studied by Dixon.[6] After being desiccated for a day at 65° to 75°C., and then for another day at 90°C., the seeds were subjected to the various temperatures for one to two hours, and then planted. In seeds which have been subjected to high temperatures germination is much slower than in the control. Also growth of the seedling is often abnormal in the case of heated seeds. The author believes, on experimental grounds, that the retardation of germination is due to some effect of the heat *per se*, and not to more complete desiccation. Some maximum temperatures withstood are the following: *Avena sativa*, 118°; *Cucurbita pepo*, 112°; *Helianthus annuus*, 112°; *Lotus tetragonolobus*, 100°; *Convolvulus tricolor*, 120°. These experiments emphasize again the great importance of imbibed water as a controlling factor in protoplasmic phenomena.—BURTON E. LIVINGSTON.

CULTURES OF PLANT RUSTS, made by Freeman[7] during the three months from March to June of the present year, are reported in the *Annals of Botany* for September. The work was done under the direction of Professor Marshall Ward at Cambridge University, and is in line with investigations instituted by Professor Ward, and in part already reported. Only uredospores of *Puccinia dispersa* E. and H. were used, obtained from but two hosts, *Bromus mollis* and *B. sterilis*, representing two of the five sections of the genus. These were sown upon forty species and varieties of Bromus, of which twenty-two showed no infection. Of the remaining kinds five were infected by spores from both sources, eleven were only infected by spores taken from *B. mollis*, while *B. sterilis* was the only kind out of the forty that could be infected with spores from *B. sterilis* alone. To secure these results about fifteen hundred cultures were made. It is such thorough and accurate work as this that will eventually give us a clear notion of the relationships of our common cereal and meadow rusts.—J. C. ARTHUR.

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[6] DIXON, H. H., On the germination of seeds after exposure to high temperatures. Notes from Bot. School Trinity Coll. Dublin **5** : 176–186. 1902.

[7] FREEMAN, E. M., Experiments on the brown rust of bromes (*Puccinia dispersa*). Ann. Botany **16** : 487–494. 1902.

IN HIS DISCUSSION of the phylogeny of the cotyledon, Lyon[8] concludes that it is a sucking organ of the embryo derived from the so-called foot of bryophytes and pteridophytes. His own summary is as follows: (1) The typical embryos of the pteridophytes and angiosperms differentiate into three primary members—the cotyledon, stem, and root; (2) cotyledons are not arrested leaves but are primarily haustorial organs originating phylogenetically as the nursing-foot in the bryophytes and persisting throughout the higher plants; (3) the monocotyledonous condition is the primitive one and prevails in the bryophytes, pteridophytes, monocotyledons, and some gymnosperms; the two (sometimes more) cotyledons of the dicotyledons are jointly the homologue of the single cotyledon of the monocotyledons; (4) the cotyledon always occurs at the base of the primary stem; (5) the hypocotyl is a structure peculiar to the angiosperms, being differentiated between the primary stem and root; (6) the so-called cotyledons of the pteridophytes and gymnosperms, with the probable exception of Ginkgo and the cycads, are true foliage-leaves.—J. M. C.

ITEMS OF TAXONOMIC INTEREST are as follows: T. E. HAZEN (Mem. Torr. Bot. Club **11**: 135–250. *pls. 20–42.* 1902) has published a revision of the Ulothricaceae and Chaetophoraceae of the United States. The species recognized in the former family are 8 in Ulothrix, 7 (1 new) in Stichococcus, 9 (2 new) in Microspora, and 3 in Tribonema; in the later family the species are 2 in Microthamnion, 13 (5 new) in Myxonema, 4 (1 new) in Chaetophora, 4 (1 new) in Draparnaldia, 1 each in Epicladia, Endoderma, and Bolbocoleon, 2 in Chaetosphaeridium, and 1 in Herposteiron. The 23 colored plates illustrate the species very completely.—L. M. UNDERWOOD and W. R. MAXON (Bull. Torr. Bot. Club **29**: 577–584. 1902), in publishing an account of a collection of Cuban pteridophytes, have described new species of Alsophila, Polypodium, Asplenium, and Diplazium.—W. A. MURRILL (*idem* 599–608), in his first paper upon the Polyporaceae of North America, has presented the genus Ganoderma, recognizing 7 species, and describing 5 of them as new.—M. L. FERNALD (Am. Jour. Sci. IV. **14**: 167–194. *pls. 5–6.* 1902), in studying the relationships of some American and Old World species of Betula, has united some well-known trees and shrubs of the two hemispheres.—J. M. C.

BREBNER[9] has published a detailed account of the development of the stem in Danaea. The author takes exception to the morphological terms *phloeoterma* and *siphonostele*, proposed by Strasburger and Jeffrey respectively, on the ground that they imply certain homologies which he is not prepared to accept. As an alternative to these morphological terms, he proposes a large number of purely formal descriptive terms, for which the reader is referred to the article in question. According to Brebner, "the haplostele (protostele of the young stem) does not pass through a medullated stage, but becomes crescentic after the departure of a variable number of leaf traces. When this stage is reached, the next leaf-trace passes off from the convexity of the crescent, thus causing a distinct leaf gap. Two meristeles are left behind with what is usually regarded as extra-stelar tissue between them. The crescent gap is closed, a leaf trace is given off, the gap is closed again, etc. By the repetition of the process, followed by branching, anastomosis, and increase in the number of leaf trace meristeles, at length a network of strands, or the dictyostele, is formed." The course of development appears to follow substantially that described for the Marattiaceae by Farmer, Hill, and Jeffrey. The author states that there is a great deal of uniformity in the anatomy of the Marattiaceae, all being adelosiphonic, with a greater or less tendency to dorsiventrality.—E. C. JEFFREY.

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[8] LYON, HAROLD L., The phylogeny of the cotyledon. Postelsia 1901: 55–86. 1902.

[9] BREBNER, G., On the anatomy of Danaea and other Marattiaceae. Ann. Botany **16**: 517–552. *pls. 22–23. figs. 28.* 1902.

DICTYOSTELIUM MUCOROIDES, one of the Myxomycetes, was discovered and described by Brefeld in 1869, since which time several investigators have studied its morphology and cultural reactions. Nadson, in 1899, asserted that he had obtained it in absolutely pure culture, although he found that it grew better with bacteria, and especially that a symbiosis existed between the mould and *B. fluorescens liquefaciens.* Potts,[10] however, has found that *D. mucoroides* will not develop entirely free from bacteria, and that the species which he isolated in connection with it was a new form, named by him *Bact. fimbriatum.* By a series of ingenious experiments he determined that symbiosis did not take place between *D. mucoroides* and either *Bact. fimbriatum, B. megatherium, B. subtilis,* or *B. fluor. liq., i. e.,* that although the mould derived benefit from the presence of the bacterium, its effect was injurious upon the latter, which underwent extracellular digestion, apparently by an enzyme secreted by the plasmodium. Living bacteria were not necessary to *D. mucoroides,* which could flourish, not upon the metabolic bacterial products, but upon the dead organisms. Besides *D. mucoroides,* a protozoan, *Amoeba nitrophila,* has been found to nourish itself through extracellular digestion (see Frosch, *Zur Frage der Reinzüchtung der Amoeben,* Centr. b. Bact. **21**$^1$: 1897). It is probable that the same is true of many other Myxomycetes and Protozoa whose method of nourishment has been problematical. The author made no attempt to isolate the enzyme, but carried out detailed experiments to determine the effect of various non-proteid media and of light, temperature, and moisture upon cultures of *D. mucoroides* and *Bact. fimbriatum.* For the germination of spores, oxygen, phosphate, organic substance, and water are necessary. Optimum reaction is 0.1 per cent. to 0.2 per cent. alkaline; optimum temperature, 23°–25° C. Attempts to isolate the mould with *B. Anthracis* or a pink yeast resulted negatively.—MARY HEFFERAN.

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[10] POTTS, GEO., Zur Physiologie des Dictyostelium mucoroides. Flora **91**: 281–347. *figs. 2.* 1902.

AN IMPORTANT CONTRIBUTION to the subject of the relation of parasite and host among the plant-rusts has been made by Professor H. Marshall Ward[11] in the *Annals of Botany*. The summer (uredo) spores of brown rust were sown upon seedlings of all available species of grasses belonging to the genus Bromus. The spores were obtained from *Bromus mollis*, *B. sterilis*, and *B. secalinus*. The result in general was the infection of most species belonging to the section of the genus which included the host from which the spores were taken, and not of species belonging to other sections of the genus.

The author undertook to find out if any anatomical or morphological differences existed in the hosts which might account for the immunity of some hosts and the susceptibility of others to the attack of the rust, and in so doing developed a wealth of data regarding the number of stomata and hairs per given area, the size of stomata, the number of leaf ribs and distances between them, the comparative area of chlorophyll tissue, and many other details that must challenge the admiration of every investigator. Each set of data is compared with the "curve of infection" and the charts so constructed show with great clearness that no correspondence exists. The discussion of these data touches upon many points that can not be mentioned here, but is most lucid and convincing and ends with the statement, that "we are driven to conclude that the factors which govern predisposition on the one hand, and immunity on the other, are similar to those which govern fertility and sterilty of stigmas to pollen." It is, therefore, to be referred, so far as we can now judge, to the quality of nutriment afforded by each host, including, doubtless, some less evident factors.

In carrying on the work it was found necessary to institute an investigation into the characters and limitations of the species of Bromus, and considerable information regarding the seeds and seedlings especially is given.

Of conditions that inhibit the development of the rust, temperature was found to be the most important, the upper and lower limits being about 27° and 10° C. respectively. The presence of green algae, or the spores of molds and other fungi, had no perceptible effect on the germination of the rust spores, neither did the presence or absence of light.

Although the paper is notable for the breadth and thoroughness of the observations, it is even more important for the clear and far reaching conclusions that are drawn from the data. It will do much to throw light upon an intricate and obscure subject.—J. C. ARTHUR.

DANGEARD[12] has recently published an extensive account of the Eugleninae. The material is very poorly arranged, without index or even a suitable

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[11] WARD, H. MARSHALL, On the relations between host and parasite in the bromes and their brown rust, *Puccinia dispersa* (Erikss.). Ann. Botany **16**: 233–315. 1902.

[12] P. A. DANGEARD, Recherches sur les Eugleniens. Le Botaniste VIII. fascs. 3–6, 97–370, *pls. 4. figs. 53.* 1902.

table of contents, and its value is therefore much impaired. Following a rambling introduction, partly historical and partly descriptive of structure and methods, is a description of the genera and species. This account is lengthy and so deficient in keys and synopses as to be of little value to the general student. The second part of the paper contains five chapters devoted to structural details, movements, nutrition, and methods of reproduction. As is well known, the Euglenineae present a wide range of variation in their feeding habits. Only one of three families, the Euglenaceae, have a halophytic nutrition, the other groups entirely lacking chlorophyll. One family, the Peranemaceae, engulfs its food as solid material in an animal-like fashion. Other forms, the Astasiaceae, are saprophytic, preferring water foul with organic matter. The Euglenaceae are especially interesting. Although generally containing chloroplasts, they may under certain conditions adopt saprophytic habits, when the chlorophyll disappears and the cell is quite devoid of pigment. The plastids in such cells are believed to remain as leucoplasts, which regain their green color under proper environment. Some of the species are normally without color.

*Euglena gracilis* is remarkable for its power of adaptation to food relations. It becomes colorless under saprophytic conditions, as when cultivated in sugar solutions away from light, but it regains its green color very readily if brought back to a more normal environment. There are differences of opinion as to the behavior of the plastids. Former writers have held that the chloroplasts simply lose their color, becoming leucoplasts, which remaining in the cell as organized bodies, assume again the chlorophyll when such was reformed in the organism. Dangeard believes that the chloroplasts may disappear entirely and be formed again *de novo*.

The chief events of nuclear division are as follows: The resting nucleus consists of a nucleolus surrounded by a chromatic spirem which is not clearly divided into segments. At division the nucleus elongates, and the nucleolus stretches into a rod which appears like an axis in the nucleus, the chromosomes arranging themselves parallel to this axis. The substance of the nucleolar axis then gradually draws apart in the center and accumulates at the poles. The chromosomes distribute themselves in two groups, which gradually separate and gather around the two daughter nucleoli and the nucleus thus divides directly. In most cases there is no trace of a nuclear membrane around the nucleus at any period of its transformations.— B. M. DAVIS.

FARMER AND HILL[13] have described the anatomy and development of Angiopteris, Marattia, and Kaulfussia. They find that the central cylinder of the stem in the first two genera originates as a solid tracheary rod surrounded by phloem (protostele.). Ordinarily, after the exit of a number of monodesmi cleaf traces a mass of parenchyma makes its appearance in the center of the tracheary tissue, which the authors regard as a true pith or medulla. Gradually the "pith" becomes enlarged as the young stem grows stouter. Sieve tubes then make their appearance between it and the xylem. Later still an endodermis is formed within the tubular stele (siphonostele), but it is not clear from the author's description whether it originates in such a way as to leave their primary "pith" in continuity with the fundamental tissues of the true pith which finally shows itself within the fibrovascular zone. It seems probable from the course of development observed in similar instances that such is not the case. Sooner or later the fibrovascular ring becomes broken up into a zone of separate strands by the overlapping of the gaps which occur above the exit of the leaf traces. Subsequently the fibrovascular system is further complicated by the appearance of strands running through the pith and joining up the walls of the stelar tube just above the points of exit of the foliar traces. The increasing complexity of the commissures leads to the extremely involved condition of the fibrovascular system which is so characteristic of the adult marattiaceous stem. The authors were unable to investigate the ontogeny of a third genus, Kaulfussia, but concluded from the structure of the adult stem that the course of development of the strands is probably the same as in Angiopteris and Marattia.

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[13] FARMER, J. BRETLAND and HILL, T. G., On the arrangement and structure of the vascular strands in *Angiopteris evecta* and some other Marattiaceae. Ann. Botany 16: 371–402. *pls. 16–18.* 1902.

They criticise the term *phloeoterma* proposed by Strasburger to denote the morphological boundary between the fibrovascular and fundamental tissues, and point out with great force the fallacy of admitting the phloeotermal value of the endodermal layer which surrounds $n+1$ fibrovascular strands, and denying it where the endodermal zone surrounds only one such strand. They conclude that the endodermis has no morphological value as a stelar boundary, both on account of its inconstant occurrence and of the frequent seriation of its cells with elements inside or outside the central cylinder. They consider that the tracheary tissue is the only reliable basis for morphological hypotheses, apparently losing sight of the fact that not unfrequently even the tracheary elements themselves appear in seriation with endodermal cells, and consequently, in accordance with the cell wall reticulum hypothesis, might belong outside the stelar system. It appears probable that greater clarity of view will supervene in developmental studies when with Sachs we cease to regard the cell wall reticulum as having any greater importance than an indication of the direction of the forces of growth. The morphological value of a structural feature seems rather to depend on its presence in older groups and in the young individual of higher groups, etc., than on histogenetic details which are extremely unstable in both animals and plants. Inconstancy of occurrence appears further to afford an argument rather for than against the ancestral character of any given morphological feature. It may consequently result that Strasburger's conception of a phloeoterma marking the boundary between the stelar and fundamental tissues will ultimately be retained in a modified form, when the present extreme revulsion of the English school of anatomists from the epoch making anatomical hypotheses of Van Tieghem has reached a condition of equilibrium.

The present work has resulted in the discovery of cambial activity in the parenchyma between the phloem and xylem of bundles in the young stem, which brings about the addition of fresh elements to the xylem. The authors discuss the parallel first instituted by Mettenius between the root-traversed cortex of the marattiaceous stem and the somewhat similar tissue present in the fossil genus Psaronius. They conclude that the two are not really comparable and suggest that in Psaronius the tissue in question results from the fusion of roots which are already outside the stem.—E. C. JEFFREY.

A NEW METHOD of studying the irritability of plant protoplasm has been devised and quite extensively applied by Bose[14]. It depends upon the existence of electric responses due to stimulation. As in animal muscle and nerve, if a limited portion of a plant tissue be injured in any way, there is produced a difference of electrical potential between the injured and the uninjured part, and a "current of injury" results, the injured region being positive with reference to the remainder of the tissue. In the case of animals a stimulus applied to a tissue exhibiting this current of injury causes a momentary but well-marked diminution in the current. A current of response or "action current" is produced which flows from the more active (uninjured) portion to the less active (injured) portion, thus producing a depression in the preexisting current of injury. This phenomenon, known in animal physiology as "negative variation," is found by Bose to occur quite generally in plant tissues. Stems, leaf stalks, flower stalks, and roots of various plants were used in the experiments. To produce the current of injury a slight burn with a potash solution is sufficient. For the negative variation a sharp mechanical blow upon the tissue or a slight torsion about its long axis was used. Records of the response were taken in the form of curve tracings, partly made by hand upon a revolving drum following the migrations of a beam of light reflected from the galvanometer, and partly recorded automatically by this beam upon a sensitive photographic plate. The response is found to be determined quantitatively by the intensity of the stimulus producing it, but some tissues (*e. g.*, leaf-stalk of turnip, celery, cauliflower) show fatigue if a uniform stimulus is repeated too often, and some show the so-called "stair-case effect" known for certain animal tissues.

Another and better method for investigating these phenomena obviates injury. The tissue to be tested is fixed firmly at a point between the two electrodes and a stimulus is applied on one side of the block thus produced. This stimulus (a blow or a torsion) is of course thus confined to the portion of the tissue on its own side of the blocking clamp, and a current of response is exhibited, the stimulated portion being positive with reference to the other.

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[14] BOSE, J. C., Electric response in ordinary plants under mechanical stimulus. Jour. Linn. Soc. Bot. **35** : 275–304. *figs. 25*. 1902.

Several curious and apparently very important analogies between the electric responses in plant tissues and corresponding ones in those of animals were brought out. (1) In stale nerve the current of response is the reverse of what it is in fresh; it flows from the less excited to the more excited, but with very strong stimulation the response becomes again like that in the fresh material. Exactly the same phenomena are observed in plant tissues. (2) Decrease in temperature causes decrease in response in animals. In plants this is also true where the tissue is otherwise known to be easily affected by cold. But in hardy plants a lowering of temperature, unless it nears the death point, does not have much affect. (3) High temperatures nearing the death point produce a fall in the intensity of response in both animals and plants. This electric method furnishes an immediate and direct means of determining the death point, for here and beyond no response can be obtained. (4) Anaesthetics and poisons have the same effect on the electric response in plants as in animals. With the application of the reagent the response is gradually depressed until it finally ceases altogether. (5) In some cases of poisons where a large dose produces depression and annihilation of response, a small dose acts as a stimulating agent and produces a rise in the response curve. This is also known in some animal tissues.

These results seem to be almost a proof of the underlying identity, or at least remarkable similarity, of plant and animal protoplasm, and hence are to be regarded as exceedingly important and fundamental. I cannot resist the temptation to suggest here, in view of the long-continued discussions as to the point where life gives place to death, that we have perhaps in this electric response the best criterion yet discovered for determining when a tissue is alive and when dead. An arbitrary definition of life might be an aid in some cases, and probably the best one which can be framed (if the properties here described are shown to be general) is that protoplasm is alive when it exhibits electric currents of response.—BURTON E. LIVINGSTON.

RECENT STUDIES UPON REGENERATION: T. H. MORGAN (Columbia Univ. Biol. Series VIII. The Macmillan Co., N. Y. 1901) has published a volume dealing with regeneration in general, especially in animals. Chapter four is devoted to regeneration in plants, and the familiar work of Vöchting and Goebel is cited, though practically nothing that is new is introduced. Morgan holds, as do most authors, that in plants a latent bud develops, while in animals there is a restoration at the cut surface. He does not accept Goebel's idea that this is due to the fact that plants have latent buds and hence do not have to restore the lost part as do animals. He opposes Sachs' theory of "Stoff und Form," as well as Goebel's modification of this theory; buds do not remain latent because poorly fed, nor do they grow because they are well fed. Morgan fails entirely to accept natural selection as a cause for the development of the capacity to regenerate; organs which are not subject to injury often regenerate, and organs of no value often replace valuable organs that were lost. Natural selection, he thinks, could not at once cause a lost organ to be perfectly restored, yet only a perfect restoration would be of any value. Teleological and vitalistic viewpoints are not looked upon with especial favor.

K. GOEBEL (Biol. Centrabl. **22**:385–397, 417–438, 481–505, 1902) has been stimulated by the recent work of Morgan and Driesch to present the present condition of our knowledge concerning regeneration in plants. He cites certain ferns in which regeneration occurs in the normal life history, while there are other cases in which a stimulus is necessary; the former live in moist, the latter in dry situations. In Bryophyllum the latent leaf buds commonly develop only when the leaf has fallen to the ground; if the midrib be cut, they develop while still on the parent plant. So too the removal of the stem buds causes the leaf buds to develop. Goebel thus thinks that there is a correlation beween the stem and leaf buds, the latter being normally inhibited from lack of food. If all leaf buds are removed, new primordia (*Anlagen*) appear at the leaf base. Other plants in which leaf buds occur are cited. Goebel has also worked on young plants of Cyclamen, a genus which was shown by F. Hildebrand in 1898 to have remarkable powers of regeneration. Hildebrand found that if the blade of the first leaf were removed, a kidney-shaped wing, resembling the lost leaf, was regenerated on each side of the petiole, and at the cut surface. If part of the blade is cut it is restored much as in animals; if the cut is made down on the petiole, the regenerated leaves may have stalks. If the young tuber is cut, leaves develop around the cut edge. An interesting summary is given of botanical literature dealing with regeneration.

Other papers on regeneration may be briefly noted: E. HEINRICHER, also J. PALISA (Ber. Deutsch. Bot. Gesell. **18**:109–121, 398–410. 1900) have studied regeneration in Cystopteris. Palisa found that any epidermal cell in the bulbil leaves can regenerate a bud capable of becoming a new plant. H. WINKLER (Jahrb. Wiss. Bot. **35**:447–469. 1900) has studied Bryopsis, which years ago Noll found to display a reversal of polarity. Noll ascribed this to the influence of gravity, but Winkler has shown that light is the determining factor. He suggests that the best nourished parts regenerate stems and the most poorly nourished parts rhizoids; the migration of chloroplasts toward the light may thus be the decisive factor in the case. Winkler regards the development of rhizoids at the stem pole as a case of heteromorphosis—the first noted in plants. This author also holds that a number of plants regenerate from the cut surface, rather than from buds, exactly as in animals.—F. NOLL (Ber. Deutsch. Bot. Gesell. **18**:444–451. 1900) accepts Winkler's view that light is the leading factor, but thinks that heteromorphosis has been known in plants though not distinctly claimed.—H. WINKLER (Ber. Deutsch. Bot. Gesell. **20**:81–87. 1902), as well as Hildebrand and Goebel, has been studying Cyclamen. Among his important results, we may note that the place at which regeneration occurs may be altered by putting a plaster of Paris cap over the cut end of the petiole. A similar cap or a coat of shellac over the leaf causes regeneration without cutting. — S. PROWAZEK (Biol. Centralbl. **21**: 87–95, 144–155. 1901) and O. HÜBNER (Zool. Jahrb. **15**: 461–498. 1902) have studied regeneration, chiefly in animals, though working on a few plant forms. Hübner adheres to Weismann's adaptation theory and thinks that the capacity for regeneration has been developed by natural selection.— H. C. COWLES.

SOME RECENT BULLETINS of the United States Bureau of Forestry add to the knowledge of the silvicultural (ecological) behavior of certain trees. Olmsted[15] discusses the relation of three forest societies in Arkansas. The "pine ridges" are the most xerophytic. More than 50 per cent. of the ridges have pine, 38 per cent. being short-leaf pine (*Pinus echinata* Mull.) and 16 per cent. loblolly pine (*Pinus taeda* Linn.). The remaining portion comprises oaks and other deciduous trees. Seedlings of the pines mentioned are found not to be tolerant of shade. In more mesophytic conditions, on the "pine flats," the loblolly pine comprises 34 per cent. of the growth, and the short-leaf pine only 20 per cent., the remaining being deciduous trees. In the hydro-mesophytic conditions along streams, the so-called "hardwood bottoms," the pines are entirely absent. This is due to the fact that these lands are frequently flooded, also the ground is too heavily forested for the germination of pine seedlings. The author gives silvicultural notes on the most important species, and in part two discusses the management of the forest.

In another bulletin Allen[16] shows that the western hemlock (*Tsuga heterophylla* Sargent) requires a climate with a heavy rainfall, and that it is exceedingly tolerant of shade. This latter characteristic is of very great importance in determining the composition of the forest in which it grows. The author also gives an excellent report of the insects that infest the tree, and emphasizes the fact that its usefulness as a lumber, tanning, and paper pulp tree has been greatly underestimated.— H. N. WHITFORD.

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[15] OLMSTED, F. E., A working plan for forest lands near Pine bluff, Arkansas. Bureau For. U. S. Dept. Agric. Bull. 32. pp. 48. *pls. 11. figs. 9.* 1902.

[16] ALLEN, E. T., The western hemlock. Bureau For. U. S. Dept. Agric. Bull. 33. pp. 55. *pls. 12.* 1902.